

Having thus defined the invention, the following is claimed:

1. An electric arc welding torch comprising a housing having a central conductive contact tube for electrical contact between a power source and a welding wire moving through the contact tube toward a workpiece in a given direction; a conductive sleeve concentric with said tube to define an annular chamber between said tube and said sleeve; a first dielectric barrier sleeve fixed on said conductive sleeve and a second dielectric sleeve on said tube, said dielectric sleeves spaced from each other to define an annular gas passage extending around and parallel with given direction of said moving wire and terminals to connect a high frequency power source between said tube and said conductive sleeve to create a dielectric barrier discharge plasma issuing from said gas passage.

2. An electric arc welding torch as defined in claim 1 wherein said frequency is greater than 500 hertz.

3. An electric arc welding torch as defined in claim 1 wherein said frequency is greater than 18 kHz.

4. An electric arc welding torch as defined in claim 1 wherein said frequency is less than 2000 MHz.

5. An electric arc welding torch as defined in claim 1 including a means for directing shield gas through said gas passage.

6. An electric arc welding torch as defined in claim 1 wherein said high frequency has an rms voltage greater than 1000 volts.

7. An electric arc welder as defined in claim 1 wherein said high frequency has a voltage in the general range of 1-40 kV.

8. An electric arc welder as defined in claim 2 wherein said high frequency has a voltage in the general range of 1-40 kV.

9. An electric arc welder as defined in claim 3 wherein said high frequency has a voltage in the general range of 1-40 kV.

10. An electric arc welder as defined in claim 4 wherein said high frequency has a voltage in the general range of 1-40 kV.

11. An electric arc welder as defined in claim 5 wherein said high frequency has a voltage in the general range of 1-40 kV.

12. An electric arc torch as defined in claim 1 wherein said passage has a gap width in the general range of 0.2-3.0 cm.

13. An electric arc torch as defined in claim 8 wherein said passage has a gap width in the general range of 0.2-3.0 cm.

14. An electric arc torch as defined in claim 7 wherein said passage has a gap width in the general range of 0.2-3.0 cm.

15. An electric arc torch as defined in claim 5 wherein said passage has a gap width in the general range of 0.2-3.0 cm.

16. An electric arc torch as defined in claim 3 wherein said passage has a gap width in the general range of 0.2-3.0 cm.

17. An electric arc torch as defined in claim 2 wherein said passage has a gap width in the general range of 0.2-3.0 cm.

18. An electric arc welder as defined in claim 1 wherein said passage has a gap width of about 0.3-0.5 cm.

19. An electric arc welder as defined in claim 3 wherein said passage has a gap width of about 0.3-0.5 cm.

20. An electric arc welder as defined in claim 2 wherein said passage has a gap width of about 0.3-0.5 cm.

21. An electric arc welding torch as defined in claim 1 wherein said dielectric sleeves are formed of a material selected from the class including ceramic, glass and polymer.

22. An electric arc welding torch as defined in claim 1 wherein said dielectric sleeves are formed of ceramic.

23. An electric arc welding torch as defined in claim 1 wherein at least one of said dielectric sleeves is formed of ceramic.

24. An electric arc welding torch comprising: concentric first and second electrode elements defining an annular shielding gas passageway between the outer cylindrical portion of the first electrode element and the inner cylindrical portion of said second electrode element and at least a cylindrical dielectric sleeve in said passageway to create a dielectric barrier discharge in said passageway when a high frequency voltage is applied across said electrode elements.

25. An electric arc welding torch as defined in claim 24 wherein said dielectric sleeve is mounted on said outer cylindrical portion of said first electrode element.

26. An electric arc welding torch as defined in claim 24 wherein said dielectric sleeve is mounted on said inner cylindrical portion of said second electrode element.

27. An electric arc welding torch as defined in claim 24 including two cylindrical dielectric sleeve in said passageway.

28. An electric arc welding torch as defined in claim 24 wherein said cylindrical dielectric sleeve is affixed to said outer cylindrical portion of said first electrode element and including a second cylindrical dielectric sleeve affixed to said inner cylindrical portion of said second electrode element.

29. An electric arc welding torch as defined in claim 28 wherein at least one of said electrodes is formed of a wire mesh.

30. An electric arc welding torch as defined in claim 27 wherein at least one of said electrodes is formed of a wire mesh.

31. An electric arc welding torch as defined in claim 24 wherein at least one of said electrodes is formed of a wire mesh.

32. An electric arc welding torch as defined in claim 31 wherein said first cylindrical electrode is a contact tube through which a welding wire is moved.

33. An electric arc welding torch as defined in claim 29 wherein said first cylindrical electrode is a contact tube through which a welding wire is moved.

34. An electric arc welding torch as defined in claim 28 wherein said first cylindrical electrode is a contact tube through which a welding wire is moved.

35. An electric arc welding torch as defined in claim 24 wherein said first cylindrical electrode is a contact tube through which a welding wire is moved.

36. An electric arc welding torch as defined in claim 35 wherein said passageway has a gap for shielding gas and said gap has a width in the general range of 0.2-3.0 cm.

37. An electric arc welding torch as defined in claim 34 wherein said passageway has a gap for shielding gas and said gap has a width in the general range of 0.2-3.0 cm.

38. An electric arc welding torch as defined in claim 33 wherein said passageway has a gap for shielding gas and said gap has a width in the general range of 0.2-3.0 cm.

39. An electric arc welding torch as defined in claim 32 wherein said passageway has a gap for shielding gas and said gap has a width in the general range of 0.2-3.0 cm.

40. An electric arc welding torch as defined in claim 31 wherein said passageway has a gap for shielding gas and said gap has a width in the general range of 0.2-3.0 cm.

41. An electric arc welding torch as defined in claim 28 wherein said passageway has a gap for shielding gas and said gap has a width in the general range of 0.2-3.0 cm.

42. An electric arc welding torch as defined in claim 24 wherein said passageway has a gap for shielding gas and said gap has a width in the general range of 0.2-3.0 cm.

43. An electric arc welding torch as defined in claim 35 wherein said passageway has a gap and said gap has a width of about 0.3-0.5 cm.

44. An electric arc welding torch as defined in claim 34 wherein said passageway has a gap and said gap has a width of about 0.3-0.5 cm.

45. An electric arc welding torch as defined in claim 33 wherein said passageway has a gap and said gap has a width of about 0.3-0.5 cm.

46. An electric arc welding torch as defined in claim 32 wherein said passageway has a gap and said gap has a width of about 0.3-0.5 cm.

47. An electric arc welding torch as defined in claim 31 wherein said passageway has a gap and said gap has a width of about 0.3-0.5 cm.

48. An electric arc welding torch as defined in claim 28 wherein said passageway has a gap and said gap has a width of about 0.3-0.5 cm.

49. An electric arc welding torch as defined in claim 24 wherein said passageway has a gap and said gap has a width of about 0.3-0.5 cm.

50. An electric arc welding torch as defined in claim 49 wherein said cylindrical dielectric sleeve is formed from a material selected from the class consisting of ceramic, glass and polymer.

51. An electric arc welding torch as defined in claim 42 wherein said cylindrical dielectric sleeve is formed from a material selected from the class consisting of ceramic, glass and polymer.

52. An electric arc welding torch as defined in claim 35 wherein said cylindrical dielectric sleeve is formed from a material selected from the class consisting of ceramic, glass and polymer.

53. An electric arc welding torch as defined in claim 31 wherein said cylindrical dielectric sleeve is formed from a material selected from the class consisting of ceramic, glass and polymer.

54. An electric arc welding torch as defined in claim 26 wherein said cylindrical dielectric sleeve is formed from a material selected from the class consisting of ceramic, glass and polymer.

55. An electric arc welding torch as defined in claim 25 wherein said cylindrical dielectric sleeve is formed from a material selected from the class consisting of ceramic, glass and polymer.

56. An electric arc welding torch as defined in claim 24 wherein said cylindrical dielectric sleeve is formed from a material selected from the class consisting of ceramic, glass and polymer.

57. A method of electric arc welding comprising:

- (a) providing a welding electrode;
- (b) creating an arc between said welding electrode and a workpiece; and,
- (c) surrounding said arc with a plasma.

58. A method as defined in claim 57 wherein said plasma is created by a dielectric barrier discharge.

59. A method as defined in claim 58 including:

- (d) providing said welding electrode as a welding wire; and,
- (e) moving said welding wire toward said workpiece.

60. A method as defined in claim 57 including:

- (d) providing said welding electrode as a welding wire; and,
- (e) moving said welding wire toward said workpiece.

61. A method as defined in claim 60 wherein said plasma is formed from arc shielding gas.

62. A method as defined in claim 59 wherein said plasma is formed from arc shielding gas.

63. A method as defined in claim 58 wherein said plasma is formed from arc shielding gas.

64. A method as defined in claim 57 wherein said plasma is formed from arc shielding gas.